Oct. 10, 1939. S. LIPSIUS 2,175,272

AUTOMATIC POWDERING MACHINE FOR THERMOGRAPHIC RAISED PRINTING

Filed Oct. 8, 1937 3 Sheets-Sheet 1

Fig. 1.

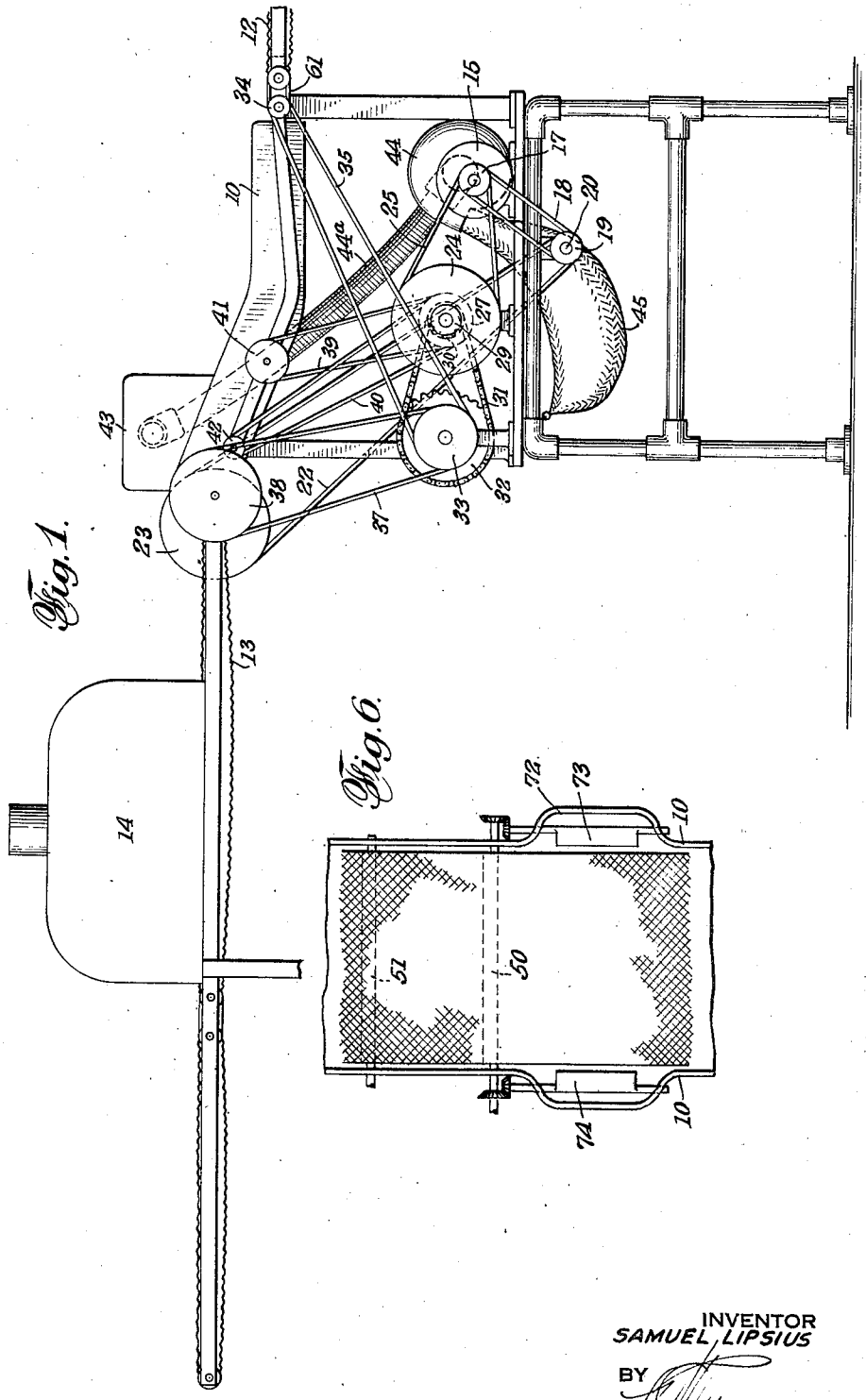


Fig. 6.

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Fig. 2.

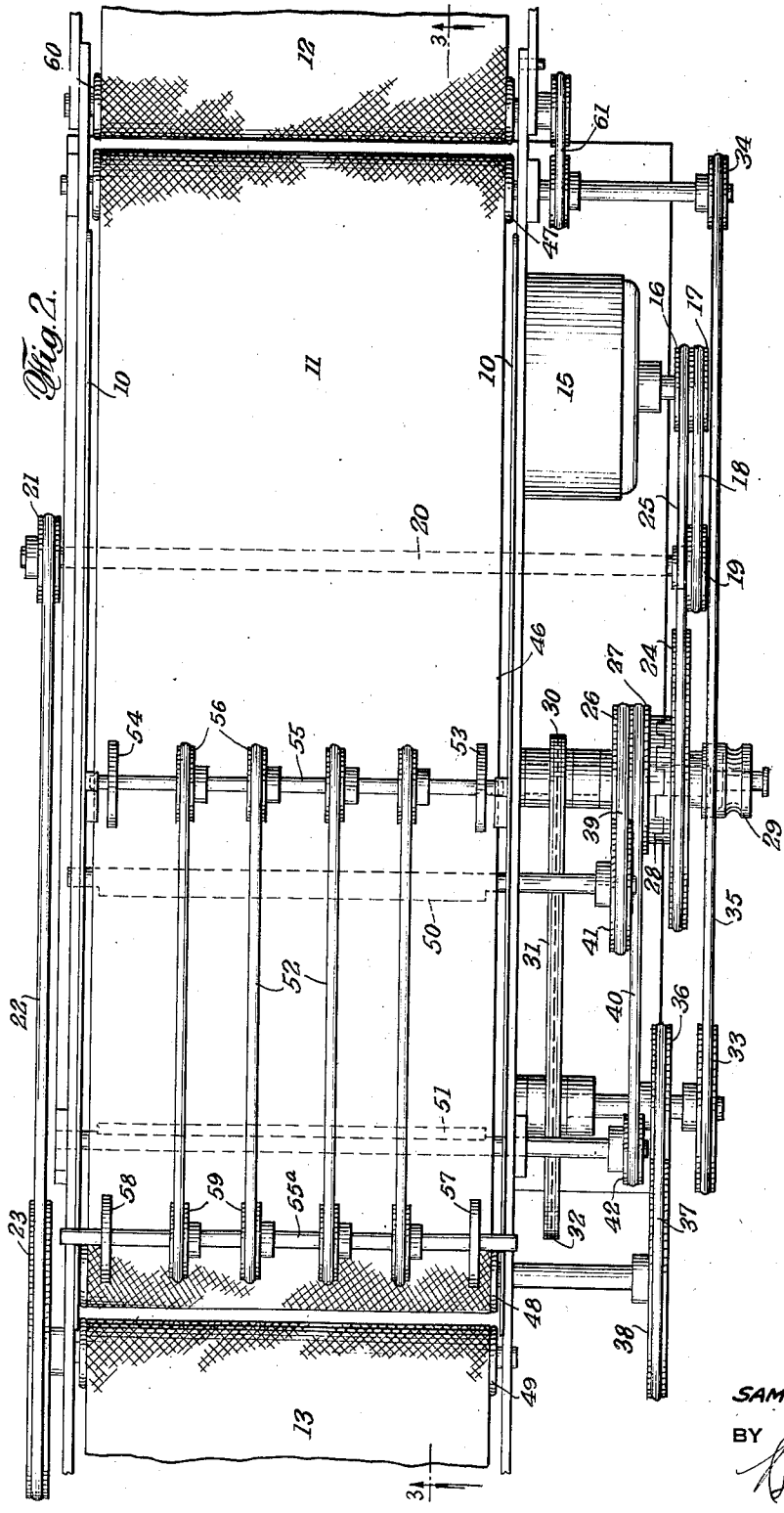
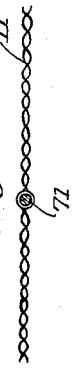


Fig. 5.



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Fig. 3.

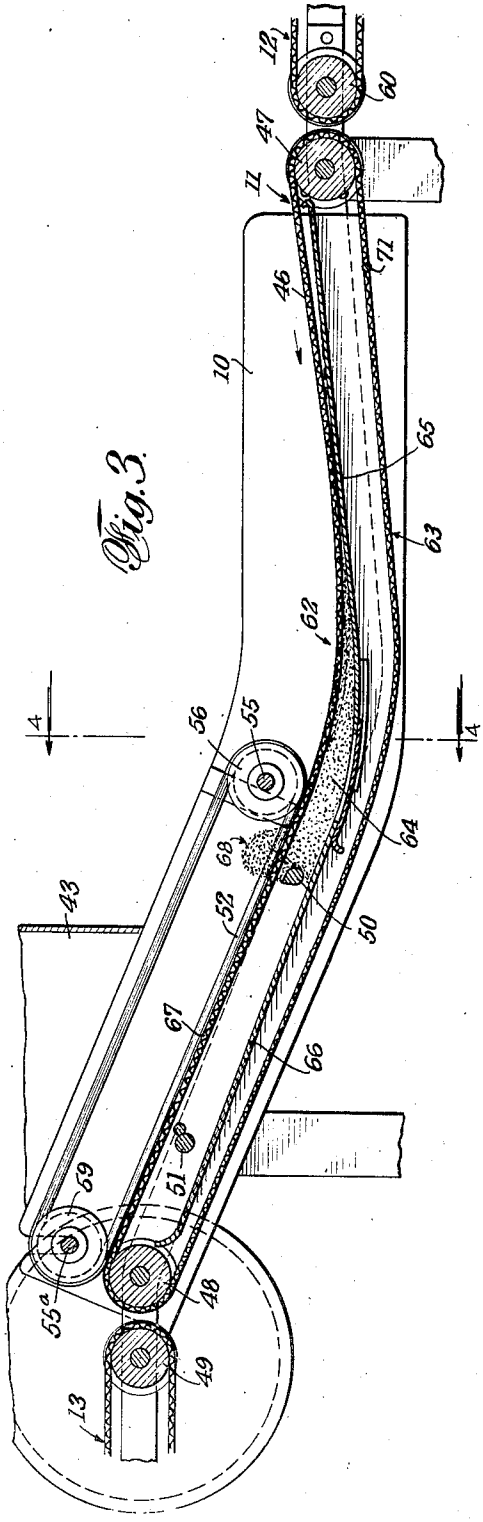
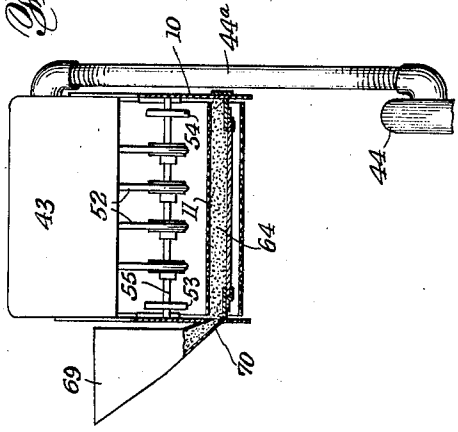


Fig. 4.



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AUTOMATIC POWDERING MACHINE FOR THERMOGRAPHIC RAISED PRINTING

Samuel Lipsius, New York, N. Y.

Application October 8, 1937, Serial No. 167,954

8 Claims. (Cl. 91—59)

In various arts for powdering work difficulty has been experienced in the formation of dust and the loss of much of the finer particles of the powder. For example, in the art of thermographic printing it is customary to sprinkle finely divided fusible particles of material like shellac over freshly printed paper, the wet ink causing some of the particles to adhere to it. The coated sheet has the excess of powdered material removed and is then passed into a heater which melts the shellac over the outline of the printed letters, the melted shellac being blackened by the wet ink. While the best thermographic printing work is done by hand, machines do the largest amount of such printing. For best results some of the powdered particles should be of a much smaller size than the others in order that these very fine particles may cling to the ink on a narrow or fine line to which the coarser grains would not adhere or be suitable.

Due to the free falling of the powder into hoppers above or below the work, or both, and onto the work much of the fine powder gets separated from the main body of powder in the usual thermographic powdering machine and the fine particles cling to the walls and sides of the machine and also get lost as dust. This results in less satisfactory work being turned out as the operation of the machine continues because the very fine particles get separated from the original properly graded mass which then possesses coarse particles in larger proportion.

It is the subjecting of the powders to air suction and blowing, or their rough usage incident to separating the powders from the air in a cyclone separator or the like for use over again, which causes the finer particles to separate from the mass of powders. In humid weather the powders become damp with the result that they do not flow freely and this has created a demand for so called "machine grade" powders and also for "extra dry" powders which have in them foreign materials, such as stabilizers, neutralizers, etc. which generally increase the fusion temperature of the powders.

This invention greatly reduces, if not entirely eliminating, these disadvantages and has for an object the provision of a machine for handling powdered materials as they are manufactured to be used, which is capable of producing better results and in thermographic printing is capable of producing results which are more nearly comparable to those heretofore attained only in handwork.

Another object is to provide a machine which is simple and inexpensive in construction.

A further object is the provision of a machine better adapted to handle stock powders as they are manufactured to be used, containing the fine grades without these fine grades getting separated from the mass of material as quickly as is the case with machines on the market today.

Yet another object is to eliminate the necessity for using specially manufactured machines or extra dry powders in thermographic powdering machines.

A still further object is to eliminate the amount of time consumed in changing from one color or type of powder to another which necessitates removing one kind of powder in a machine and replacing it with a different kind.

Referring to the drawings:

Fig. 1 is a side elevation of one embodiment of this invention.

Fig. 2 is a top plan view of the device of Fig. 1.

Fig. 3 is a side view partly in section of the conveyor, powder reservoir, etc.

Fig. 4 is a section on the line 4—4 of Fig. 3.

Fig. 5 shows one way of securing the end portions of the conveyor belt together.

Fig. 6 exemplifies a modified embodiment of this invention.

In Fig. 1 between the sides 10 of the machine travels the conveyor 11 carrying work to be coated with powder. A preliminary conveyor 12 may have work delivered to it automatically or by hand for feeding the conveyor 11.

After passing through the powdering machine the work is delivered onto a conveyor 13 which passes it across the heater 14 after which the work may be delivered where and as desired. An electric or other motor 15, shown in Figs. 1 and 2, drives a shaft having the pulleys 16 and 17. The belt 18 drives the pulley 19 from the pulley 17, rotates a shaft 20 extending transversely across the machine to the pulley 21 for driving the belt 22 and the pulley 23 for actuating the conveyor 13. Another pulley 24 is driven by the belt 25 from the pulley 16 and said pulley 24 rotates the pulleys 26 and 27 and the sprocket 30, all through the interposition of a clutch 28 controlled by the handle 29.

When the handle is moved inwardly to engage the clutch, pulleys 26 and 27 and the sprocket 30 are driven but when the clutch 28 is disengaged by the handle being pulled out, then the motor drives only the conveyor 13. A chain 31 around the sprocket 32 drives the conveyor 11 from the sprocket 30. A pulley 33 on the shaft of sprocket

32 drives the pulley 34 through the belt 35 for rotating roller 47 and pushing the work carrying portion of the conveyor 11. Another pulley 36 on the shaft of sprocket 32 drives pulley 38 through the belt 37 for rotating roller 48 and pulling the upper work carrying portion of the conveyor 11. Belts 39 and 40 from the pulleys 26 and 27 drive the pulleys 41 and 42, respectively, for rotating the vibrators 50 and 51.

While a feature of this invention is the free movement of the powdered material only a short distance so as to minimize the separation referred to, a suction hood 43 may be placed over the upper end portion of the conveyor 11 to catch floating particles. A suction fan 44 driven by the motor creates the desired suction in the hood 43, the pipe 44a connecting the fan and hood. A detachable bag 45 is pivoted at its left end as shown in Fig. 1 and at its right end portion removably connected to the fan so that the bag 45 may be easily emptied to remove any dust particles collected.

The conveyor 11 is a commercial type of wire mesh 46 consisting of helices linked together and joined at their ends. The roller 47 over which the wire mesh conveyor travels may be provided with a few upstanding projections as illustrated in Fig. 3. The roller 48 at the other end of the same conveyor is of the same general construction as is also the roller 49 for the conveyor 13. The lower end of the conveyor is carried by the infeeding roller 47 and arranged at a convenient level and the upper end is carried by the discharge roller 48 at a much higher level so that a part of the conveyor is inclined upwardly beyond the approximate center of the conveyor.

To assist in holding the work on the conveyor 11 as it travels up the inclined portion 67 there are provided a number of yieldable conveyors and in the embodiment illustrated these take the form of a number of belts 52 passing over rolls 56 and 59 mounted on the shafts 55 and 55a. These belts and their driving pulleys are maintained normally out of contact with the conveyor 11 and the work by means of supporting rollers 53, 54, 57 and 58 on the shafts 55 and 55a, which ride on the conveyor 11 and support the belts 52 at points adjacent the rollers about an eighth of an inch, more or less, above the surface of the conveyor 11.

The vibrators 50 and 51 operate to knock or raise the conveyor upwardly a small amount into contact with the superposed conveyors 52. Inasmuch as the overhead conveyors 52 travel at substantially the same rate as the conveyor 11 it will be understood that they assist in holding the work on the conveyor as it travels up the incline and while being vibrated to free the work of excess powder. The expedient of maintaining the work normally out of contact with the superposed conveyor and allowing it to engage the overhead conveyor only intermittently is more effective to safeguard the work against injury by the overhead conveyor than would be the case if the overhead conveyor were continually in contact with the work during its travel up the incline. Instead of the flexible belts illustrated a number of aluminum rollers coated with electrified sheepskin might be yieldably mounted slightly out of contact with the conveyor surface and driven at the same linear speed for the same purpose. The driving rollers 53 and 54, 57 and 58 are preferably driven by their friction contact with the conveyor 11 and may be of metal coated with rubber or the like on their peripheries.

The roller 60 for the preliminary work carrying conveyor 12 may be driven by the belt 61 from the pulleys illustrated in Fig. 2.

In Fig. 3 it will be seen that the upper half 62 of the conveyor 11 is the effective work carrying portion, the lower half 63 being located below a reservoir 64 or receptacle for finely divided powder particles.

The reservoir 64 is formed by the sides and bottom plates 65 and 66 beneath the shaft 55. The bottom plate 65 serves to support a part the in-feeding portion of the conveyor 11 and is preferably slightly inclined downwardly as it extends toward the reservoir so that any powder falling upon it will be fed into the reservoir 64 by the conveyor. The bottom plate 66 is spaced below the conveyor and is inclined downwardly toward the reservoir so that powder falling upon it will fall by gravity toward the reservoir.

The rotatable throwing device 50 is provided with one or a plurality of blades which take up enough powder to cause it to be thrown slightly above the conveyor in the form of a cascade extending across the conveyor just above the shaft 55 and its attached parts. The blade or blades of this throwing device may contact the conveyor to raise it sligthly as it is vibrated or it need not necessarily act to vibrate the conveyor. The blade or blades of this throwing device 50 also substantially contact with the inclined bottom plate 66 of the powder reservoir and are therefore effective to positively feed or force gravity returned excess particles into the main body of the powder within the reservoir. The conveyor travels in substantial contact with the top of the powder in the reservoir 64 but it is the throwing device 50 which causes the powder to be moved upwardly above the conveyor onto the printed articles on the conveyor beneath the shaft 55 and the connected parts.

As any work such as a sheet of paper containing fresh printing passes through the spouting or cascading powder 68, the particles of powder cover and stick to any of the freshly printed inked portions of the paper. After being coated the work travels up the incline 67 on the conveyor 11 so that gravity will cause excess powder particles to fall off from the sheet and be returned by sliding down the inclined bottom 66 to the rotatable device 50 which may positively feed them back into the main reservoir. In addition to gravity the vibrator 51 serves to vibrate the upper inclined portion of the conveyor rapidly to still further and better free the work of loose powder particles so that they may fall back through the meshes of the conveyor on to the bottom plate and hence find their way into the reservoir 64. The vibrator 51 thus causes the conveyor 11 to be raised until the work contacts the flexible belts 52 which assist in holding the work as it travels up the incline.

To maintain additional powder in the reservoir 64 as it is used up in operation of the machine there may be provided a second reservoir 69 mounted at one side of the machine and having a restricted passageway 70 preferably of about an inch in diameter extending into the reservoir 64 through one of the side walls 10. The top of the discharge opening between passage 70 and the reservoir 64 should be below the surface of the powder in the reservoir 64 or at least not substantially above it. In this way the level of the powder in the reservoir 64 being up to or above the top of the discharge opening from the reservoir 69 prevents the flowing of any additional powder from reservoir 69 and it is not

until the level of the powder in the reservoir 64 has fallen slightly below the top of the discharge opening in the side wall 10 that powder will then be able to flow freely under gravity from the reservoir 69 into the reservoir 64. In other words, the friction of the powder particles in the reservoir 64 prevents the powder in one reservoir from freely flowing as would a liquid into the other reservoir and this is why the level in the reservoir 64 may be automatically maintained from the reservoir 69.

As is common in the art of flexible belting the conveyor 11 may have its connected ends separated by extraction of a pin 71 extending across the width of the conveyor and holding together the looped end portions of the wire mesh.

If the rotatable throwing device 50 serves to vibrate the conveyor a sufficient amount the additional vibrator 51 may not be needed. More than one rotatable throwing device 50 may also be used to aid in throwing the powder above the conveyor. In Fig. 6, for example, is shown an embodiment of the invention in which additional rotatable throwing devices 73 and 74 are located in lateral recesses or pockets 72 in the sides of the powder reservoir for the purpose of throwing the powder from the sides onto the work conveyor where substantially continuous printed strips are being used or where the apparatus described in Fig. 3 may not be entirely suitable due to the large area of work to be coated with powder. In the device of Fig. 6 the transverse throwing device 50 may or may not be used with the laterally placed throwing devices 73 and 74. The vibrators and throwing devices of Fig. 6 may be driven in the same general manner as is illustrated in the previous figures.

Among the advantages of this invention may be mentioned its adaptability in the thermographic printing art to take the place of prior art machines costing at least about double or more than is required to construct the simple and convenient construction illustrated. Due to the absence of any air blast for cleaning off excess and to the absence of the powder particles falling freely any substantial distance into hoppers or reservoirs either above or below the conveyor, the danger of dust being created and excessive loss of the finer particles in the fusible powders used, is substantially minimized. In other words, the simple machine of this invention because of the small free movement of the powder in spouting above the conveyor from beneath it causes less dust and less separation of the finer or smaller particles of powder as the operation of the machine continues with the result that the product of this machine after continued use is more nearly comparable of the fine grade of work resulting from the best hand operations and is substantially better than the type of work heretofore attainable in many machines. Due to the small free movement of the powder and the prevention of separation of finer from the coarser grades it is unnecessary to use the so-called "special dry" powders with the apparatus of this invention and it is also unnecessary to use the stabilizers and neutralizers heretofore found necessary for many machine powders.

The rotating device 50 travels just fast enough to throw the powder particles a short distance above the conveyor and a distance of a half to an inch above the conveyor has been found ample to satisfactorily distribute the powder over the work. In event it is desired to change the type of powder being used from one color to another or for any other purpose, it is only necessary to pull out the clutch stopping the present machine while continuing the conveyor 13 moving past the heater and preventing any parts of the heater conveyor becoming excessively or dangerously hot. While the powdering machine is stopped the bottom 75 of the powder reservoir may be opened and the powder taken out and the reservoir refilled with the particular powder desired. The powder having less movement than in prior art machines, makes it easy for the operator to brush off remaining powder particles from the sides, bottoms or from the conveyor or vibrator and this is one reason the change from one type of powder to another is simpler and easier with the machine illustrated than with numerous prior art constructions.

Another advantage is the provision of a superposed conveyor for holding the work as it travels up the incline yet which is so constructed that this second conveyor contacts with the work only periodically and not continuously with the result that there is less likelihood of powder particles being rubbed off where they should not be removed. The rotatable throwing device illustrated in Fig. 6 may throw the powder through the conveyor or may not throw it through the conveyor but only throw it around the ends or side edges of the conveyor so as to coat substantially the full width of the conveyor.

The rotatable throwing device 50 shown in Fig. 3 is given a counterclockwise direction of rotation in order to positively feed the gravity returned excess into the powder reservoir and at the same time cause the powder to be thrown up slightly above the conveyor. The positive feeding of the powder into the reservoir from the front as well as from the rear is a noteworthy feature of the present invention. The openings in the wire mesh conveyor 46 are about 3/8 of an inch wide although of course other sizes and shapes of conveyor material may be used. The absence of any additional hoppers or reservoirs for powder above and below the conveyor and into which powder would be discharged to fall a substantial distance, is another advantageous feature of this invention. The vibrating of the conveyor as it travels up the incline is advantageous in removing and returning excess powder from the work without creation of dust or the loss of fine particles as occurs with the air blast or suction methods.

Location of the powder reservoir between the upper and lower halves of the conveyor minimizes the amount of travel which the particles of powder have to undergo.

The conveyor 11 is substantially contiguous the sides 10 of the reservoir.

The rolls 56 and 59 for the flexible belts 52 or the sheepskin rolls if used are each mounted in side frames having open slots so that they may be moved upwardly in case of impact by the conveyor 11 or for any other reason. Instead of a rotatable throwing device for powder, if the bottom of the reservoir be made resilient somewhat like a drum head, the powder might be thrown above the conveyor by causing the reservoir bottom to vibrate. In the embodiment illustrated the reservoir bottom may be vibrated by either or both the vibrators 50 and 51 to facilitate the return of excess powder to the main body of the powder mass. The sides 10 and bottom of the reservoir 64 constitute a housing which may or may not be enclosed across the top for substantially the full length of conveyor travel.

I claim:

1. A powdering device which includes an endless conveyor having a lower portion and an upper portion traveling in an opposite direction to the lower portion and on which upper portion a printed sheet or the like is adapted to be carried, a reservoir having side walls and a bottom for powdered material for thermographic raised printing, said reservoir being of substantial extent in the direction of travel of said conveyor and located between the upper and lower portions of the conveyor close enough to said upper or work carrying portion of the conveyor to minimize the formation of dust and separation of fine particles in any powdered material falling from said conveyor and any work thereon, a lift means in said reservoir closely adjacent the upper portion of the conveyor and adapted to throw the powdered material only a short distance above the conveyor, said conveyor and a portion of the reservoir beyond said lifting means being upwardly inclined in the same general direction beyond said lifting means whereby any powdered material falling from the conveyor and work may have only a short fall through the air to minimize the formation of dust and separation of fine particles of material, means for holding the work on the conveyor as it travels upwardly, and means for vibrating the conveyor and work to shake off any loose powdered material after passing said lifting means, any loose powdered material shaken off said conveyor onto the upwardly inclined portion of said reservoir being returned by gravity to said lifting means.

2. A powdering device including an endless belt type open mesh work carrying conveyor passing over rollers, a reservoir for powdered material for thermographic raised printing, said reservoir being located between the upper and lower portions of said conveyor, said reservoir having a bottom with upstanding side walls closely adjacent the sides of said conveyor, a device in said reservoir closely adjacent the upper portion of the conveyor for throwing the powdered material above the conveyor onto work carried by the conveyor, the reservoir bottom extending substantially beyond said throwing device in the direction of conveyor travel and on each side thereof, the upper portion of the conveyor at least in part scraping the bottom of the reservoir as it approaches the said throwing device to feed any loose particles of powdered material toward said device, and means for removing loose powdered material from the conveyor after it has passed said device and returning the material to adjacent said device, the upper portion of the conveyor being loose enough to ride over the top of the powdered material in the reservoir, said throwing device being located adjacent the bottom of the reservoir and being at times in contact with the conveyor.

3. A powdering machine for raised printing comprising, a powder receiver having a bottom between upstanding sides, an endless meshwork conveyor passing between spaced rollers, its upper run being adjacent the sides of the reservoir and the powder therein, the lower run of the conveyor being below the bottom of the reservoir, a means in the reservoir and closely adjacent the underside of said conveyor for throwing powder above the conveyor and onto a worksheet carried thereby, a portion of the conveyor beyond said mechanism being inclined upwardly, means for holding a worksheet on the conveyor as it travels upwardly, means for removing loose particles of powder from said worksheet, the bottom of said reservoir being inclined upwardly and extending for a substantial portion of the length of the inclined upper run of the conveyor beneath but spaced from the upwardly inclined portion of the upper run of the conveyor whereby powder removed from said sheet may be returned by gravity to said mechanism.

4. A powdering machine for raised printing comprising, a powder receiver having a bottom between upstanding sides, an endless meshwork conveyor passing between spaced rollers, its upper run being adjacent the sides of the reservoir and the powder therein, the lower run of the conveyor being below the bottom of the reservoir, a means in the reservoir and closely adjacent the underside of said conveyor for throwing powder above the conveyor and onto a worksheet carried thereby, a portion of the conveyor beyond said mechanism being inclined upwardly, means for holding a worksheet on the conveyor as it travels upwardly, means for removing loose particles of powder from said worksheet, the bottom of said reservoir being inclined upwardly and extending for a substantial portion of the length of the inclined upper run of the conveyor beneath but spaced from the upwardly inclined portion of the upper run of the conveyor whereby powder removed from said sheet may be returned by gravity to said mechanism, said powder throwing means including a rotatable vane device on an axis transverse to the conveyor travel, between and closely adjacent said conveyor upper run and the bottom of the reservoir and being rotated in a direction such that powder returning to said throwing means and sliding down the inclined portion of the reservoir bottom, is pushed by said device into the portion of the reservoir containing the major part of the powder.

5. A powdering machine for raised printing comprising, a powder receiver having a bottom between upstanding sides, an endless meshwork conveyor passing between spaced rollers, its upper run being adjacent the sides of the reservoir and the powder therein, the lower run of the conveyor being below the bottom of the reservoir, a means in the reservoir and closely adjacent the underside of said conveyor for throwing powder above the conveyor and onto a worksheet carried thereby, a portion of the conveyor beyond said mechanism being inclined upwardly, means for holding a worksheet on the conveyor as it travels upwardly, means for removing loose particles of powder from said worksheet, the bottom of said reservoir being inclined upwardly and extending for a substantial portion of the length of the inclined upper run of the conveyor beneath but spaced from the upwardly inclined portion of the upper run of the conveyor whereby powder removed from said sheet may be returned by gravity to said mechanism, the top run of the conveyor being substantially contiguous the powder in said reservoir.

6. A powdering machine for raised printing comprising a bottom plate having a downwardly inclined introductory portion and an inclined portion extending upwardly therefrom, a meshwork conveyor having upper and lower runs, a portion of its upper run travelling forwardly on the upper surface of the downwardly inclined portion of said bottom plate for moving powder on said inclined portion to the bottom of said inclined portion and a portion of its upper run extending above the upwardly inclined portion of the bottom plate and leaving a space between the upper

run of the conveyor and the bottom plate adjacent the juncture of the two portions thereof constituting a powder holding reservoir, means for throwing powder from said reservoir onto articles being carried forwardly on said conveyor, and means for vibrating the articles on the upwardly inclined portion of the conveyor so as to jar loose the excess particles of powder on the articles and leave them free to fall by gravity back into the reservoir.

7. A powdering machine for raised printing comprising a bottom plate having an introductory portion and an inclined portion extending upwardly from the rear thereof, a meshwork conveyor having upper and lower runs, a portion of its upper run travelling forwardly on the introductory portion of said bottom plate and a portion of its upper run extending above the upwardly inclined portion of the bottom plate and leaving a space between the upper run of the conveyor and the bottom plate constituting a powder reservoir beneath the lower end of the inclined portion of the conveyor, means for throwing powder from said reservoir through said conveyor onto articles being carried forwardly on said conveyor, means for vibrating the articles on the upwardly inclined portion of the conveyor so as to jar loose the excess particles of powder on the articles and leave the particles free to fall by gravity back into the reservoir, overhead conveyor elements movable with respect to the conveyor to and from the conveyor and coacting with articles on the inclined portion of said conveyor for carrying the articles along and means for vibrating part of the bottom plate beneath the inclined portion of the conveyor so as to loosen powder collected thereon and permit it to fall by gravity to the reservoir.

8. A powdering machine for raised printing comprising a bottom plate having an introductory portion and an inclined portion extending upwardly therefrom, a meshwork conveyor having upper and lower runs, a portion of its upper run travelling forwardly on the introductory portion of said bottom plate and a portion of its upper run extending above the upwardly inclined portion of the bottom plate and leaving a space between the upper run of the conveyor and the bottom plate constituting a powder reservoir, means for throwing powder from said reservoir through said conveyor onto articles being carried forwardly on said conveyor, means for vibrating the articles on the upwardly inclined portion of the conveyor so as to jar loose the excess particles of powder on the articles and leave them free to fall by gravity back into the reservoir, and conveyors coacting with the upwardly inclined portion of the meshwork conveyor including a shaft having rollers supported on the meshwork above said reservoir and belts driven by said shaft and having lower runs travelling above the meshwork and the articles carried thereby.

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